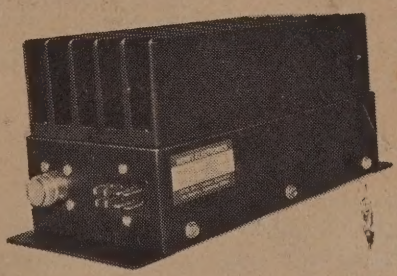
HENRY/TEMPO SOLID STATE VHF AMPLIFIERS

OPERATING AND MAINTENANCE MANUAL

INCLUDING MODELS:

C80A30	80A30
C80A10	80A10
C80A02	80A02
C50A10	50A10
C50A02	50A02



Henry Radio

11240 West Olympic Boulevard Los Angeles, California 90064

PLEASE NOTE

All rated amplifier outputs are measured with maximum defined drive (3 watts for -02 amplifiers, 15 watts for -10 amplifiers, and 40 watts for -30 amplifiers) and an operating voltage of 13.8 VDC. Additionally, the amplifier should be operated into a 50 ohm load. Keep all coax leads as short as possible, because line loss is definitely significant at 150 and 450 MHz. When the amplifier is operated at less than optimum conditions, the power output will be less than maximum.

WARRANTY

Henry Radio warrants each new product sold by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit which under normal installation, use, and service discloses such defect, provided the unit, or part, is delivered by the original owner to us intact for our examination, with all transportation charges prepaid to our factory, within ninety days from the date of sale to the original purchaser and provided that such examination discloses in our judgment that it is thus defective. Should a malfunction be suspected, write in detail to our service department for suggestions concerning the operation, repair, or return of your unit if it should prove necessary.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of the instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory, nor in cases where the serial number thereof has been removed or defaced or changed, nor to units used with accessories not manufactured or recommended by us.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by Henry Radio without charge to the owner. This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

Henry Radio reserves the right to make any improvements to its products which it may deem desireable without obligation to install such improvements in its previously sold products.

TABLE OF CONTENTS

SPECIFICATIONS:

POWER OUTPUT
80A models 60 - 80 watts
50A models 40 - 50 watts

FREQUENCY RANGE
135 -175MHz

HARMONIC ATTENUATION
Better than 70 db below carrier with commercial filtering

POWER REQUIREMENTS
13.8 VDC nominal
11 to 15.5 VDC possible
5 ma nominal - standby
130A . . . 18 amps nominal max.
80A . . . 14 amps nominal max.
50A . . . 9 amps nominal max.

INPUT — OUTPUT IMPEDANCE
50 ohms unbalanced nominal

ANTENNA CHANGEOVER
Automatic built-in RF sensing

MONITOR
Remote relative RF output

DRIVE REQUIREMENTS
A30 models 20 - 40 watts
A10 models 5 - 15 watts
A02 models .8 - 4 watts

BANDWITH
Approximately 4 MHz without retuning

DUTY CYCLE
50% with no external cooling
100% with external cooling

TYPE OF EMISSION FM

MISMATCH PROTECTION
Balanced emitter transistors will withstand infinite VSWR

CONTROLS Remote off

DIMENSIONS
9.5" long x 3.5" high x 4" wide

HENRY/TEMPO SOLID STATE VHF POWER AMPLIFIERS OPERATING AND MAINTENANCE MANUAL

SECTION 1 TYPE ACCEPTANCE INFORMATION

With the installation of commercial filtering, these amplifiers are type accepted for operation under all applicable parts of the land mobile and fixed base station services. However it is the responsibility of the technician installing and tuning the amplifier to hold the proper class of FCC commercial license and to be familiar with the rules and regulations pertaining to the power output permissible under the class of station license the amplifier is to be used with.

Also, it is extremely important to consult the specifications published by the manufacturer of the exciter. This will insure that the power level which the transceiver will be raised to will not invalidate its full acceptance because of spurious content or frequency stability.

The technician must determine what the maximum power level is in the class of operation he intends to use the amplifier. We suggest that the technician consult the FCC publications regarding the regulations.

For all regulations calling for the measurement of the final input power, consult sections 4 and 5 of this manual.

To comply with any regulation regarding low power capability, see Section 6 describing the function of the control jack.

The content of harmonic spurious signals generated by this amplifier is attenuated far in excess of the FCC requirements for the service that the amplifier is type accepted. The attenuation of these spurious signals is guaranteed in the design of the amplifier as well as by the use of a low pass filter on the output of the amplifier section.

SECTION 2 UNPACKING AND INSTALLATION

The solid state amplifier you have purchased was tested and aligned at the factory for the frequency you requested. Further alignment should not be necessary. The solid state devices in your amplifier are easily damaged if they are serviced incorrectly. The equipment warranty can not cover damages caused by negligent service, therefore we recommend that all service by carried out by a well trained technician.

Remove the amplifier from its shipping box and packing material and examine it for visible damage. If the equipment has been damaged in shipment, save the box and packing material and notify the transportation company immediately. DO NOT put the amplifier into service if it has been damaged.

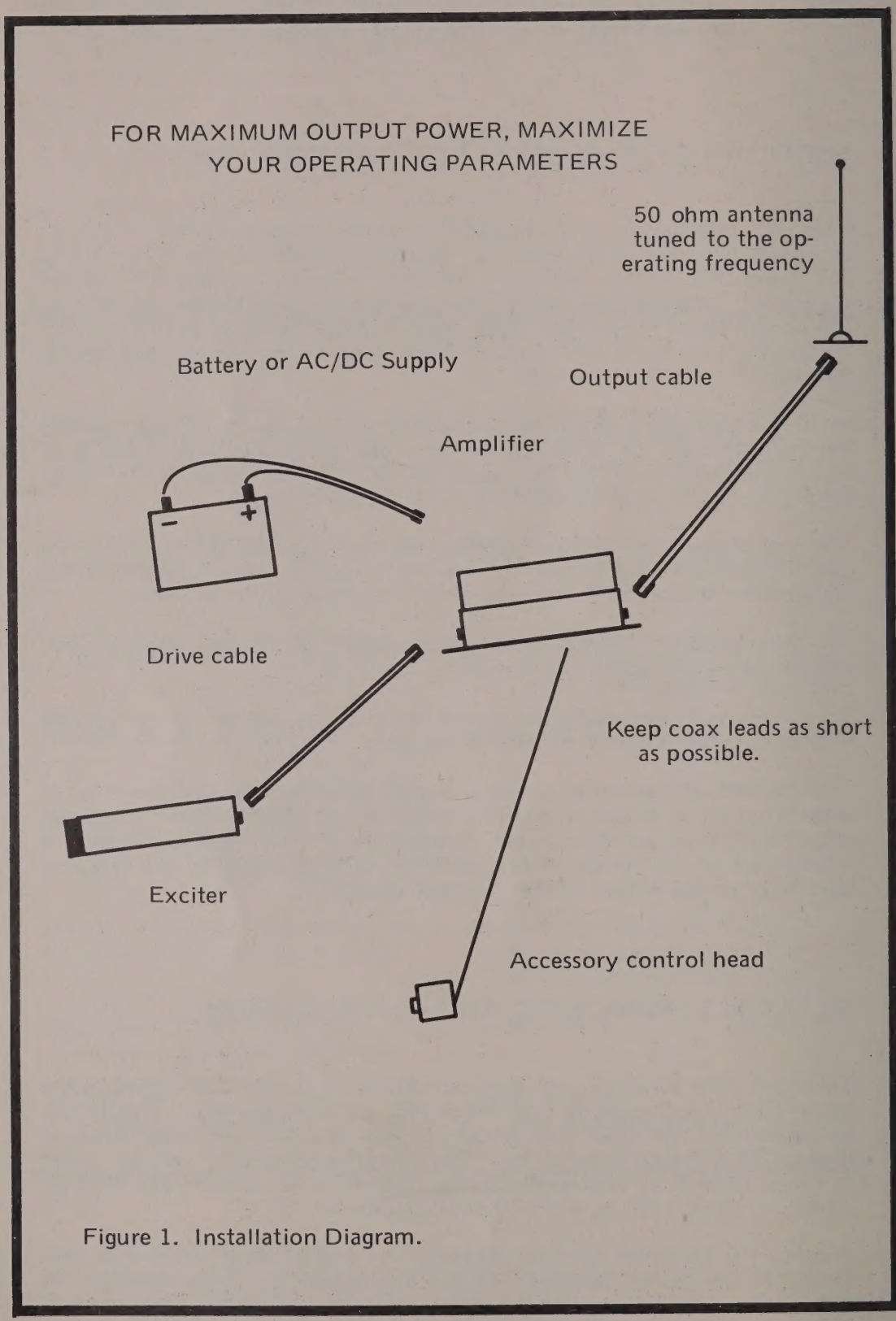


Figure 1. Installation Diagram.

All necessary cables should be provided with the amplifier. Special cables or connectors can be supplied on request. When installing the amplifier, keep in mind that the equipment should be mounted as closely as possible to the 13.8 VDC power source to prevent low output caused by a voltage drop in the DC cable. We recommend installation inside the vehicle for mobile installations. The red (or white) power lead connects to the battery's positive (+) terminal and the black DC lead connects to the battery's negative (—) terminal. Figure 1 is a diagram of the necessary interconnections.

The DC power cables should be connected directly across the battery to prevent damage to the ignition system of the car caused by the high operating current of the amplifier. Screw the amplifier into position at the location desired and plug the DC power cable into the 13.8 VDC connector (8-pin Jones plug) of the amplifier.

Connect the RF OUT coax connector to an appropriate antenna (50 ohms) using coaxial cable. Remember that long coax leads cause significant power losses at VHF and UHF frequencies. Connect the supplied drive cable to the exciter and to the RF IN coax connector of the amplifier.

The installation is complete when all of these connections have been made.

For base station installations, the amplifier must be connected to a 13.8 VDC source (either a storage battery or an AC to DC power converter) capable of supplying the necessary current.

The amplifiers are designed to key into transmit automatically whenever they are driven with more than about .5 watts. The CONTROL jack, described in Section 6, disables the automatic keying circuit for low power operation.

For optimum output power, remember that the voltage at the amplifier, the drive power, the length of the coax lead, and proper antenna tuning are all important operating parameters. Low output is usually caused by not having a proper installation.

SECTION 3 CIRCUIT DESCRIPTION

3.1 MODEL 80A02

The circuit diagram of the amplifier is shown in Figure 2. The amplifier consists of three distinct circuits: An RF sensor and relay circuit, a preamplifier stage, and a final power amplifier stage.

In the sensing-relay circuit, RF from the antenna to J3 (RF OUT) goes directly through the relay and J1 (RF IN) into the transceiver during receive. During transmit the RF from the transceiver enters the amplifier through J1 (RF IN) and creates a DC voltage across diode D1; The voltage is amplified by Q1 to trip relay RY1 causing the signal to enter the amplifier sections. Grounding the base circuit of Q1 disables the sensing circuit to turn the amplifier off. D1 senses the RF output power

creating a current at the tip portion of J2 (CONTROL) for monitoring of relative output on an external meter.

In the preamplifier section (driver stage) the base of Q2 is matched to 50 ohms by L2, C10, C11, C12, and R5. These components form a pi strip line matching network. L2, like most of the other coils in the amplifier, is printed on the circuit board and is not a replaceable component.

The output power from Q2 (20 to 40 watts) is matched to and divided between the three transistor final output stages Q3, Q4, and Q5 by L4-L6, C13, C14 and C15-C17. C15, C16, and C17 with printed inductors L4, L5 and L6 form a pi strip-line matching section and a simulated ¼ wave power divider which is adjustable with trimmers C13 and C14. L3, C4, C5 and C6 are used to decouple the collector of Q2 from the power line.

Power from the final transistor stages is recombined and raised in impedance by L7-L9 and C18-C20. These components form a band-pass filter which serves to attenuate harmonics more than 50 db below fundamental carrier level. C7, C8, C9, and L11 serve to decouple the final stage from the supply line.

D4 is a reverse polarity protection diode. The amplifiers are designed to operate from a negative ground system. The amplifiers' boards are glass epoxy.

3.2 MODEL 80A10

The 80A10 amplifier is identical to the 80A02 in all respects except for the substitution of a lower gain transistor at Q2 in the driver stage.

3.3 MODEL 80A30

The 80A30 amplifier is basically the same circuit as the 80A02 and 80A10. The difference is the deletion of the driver stage, Q2 and its related components. The drive from the transceiver passes through the relay and enters the amplifier stage at C13.

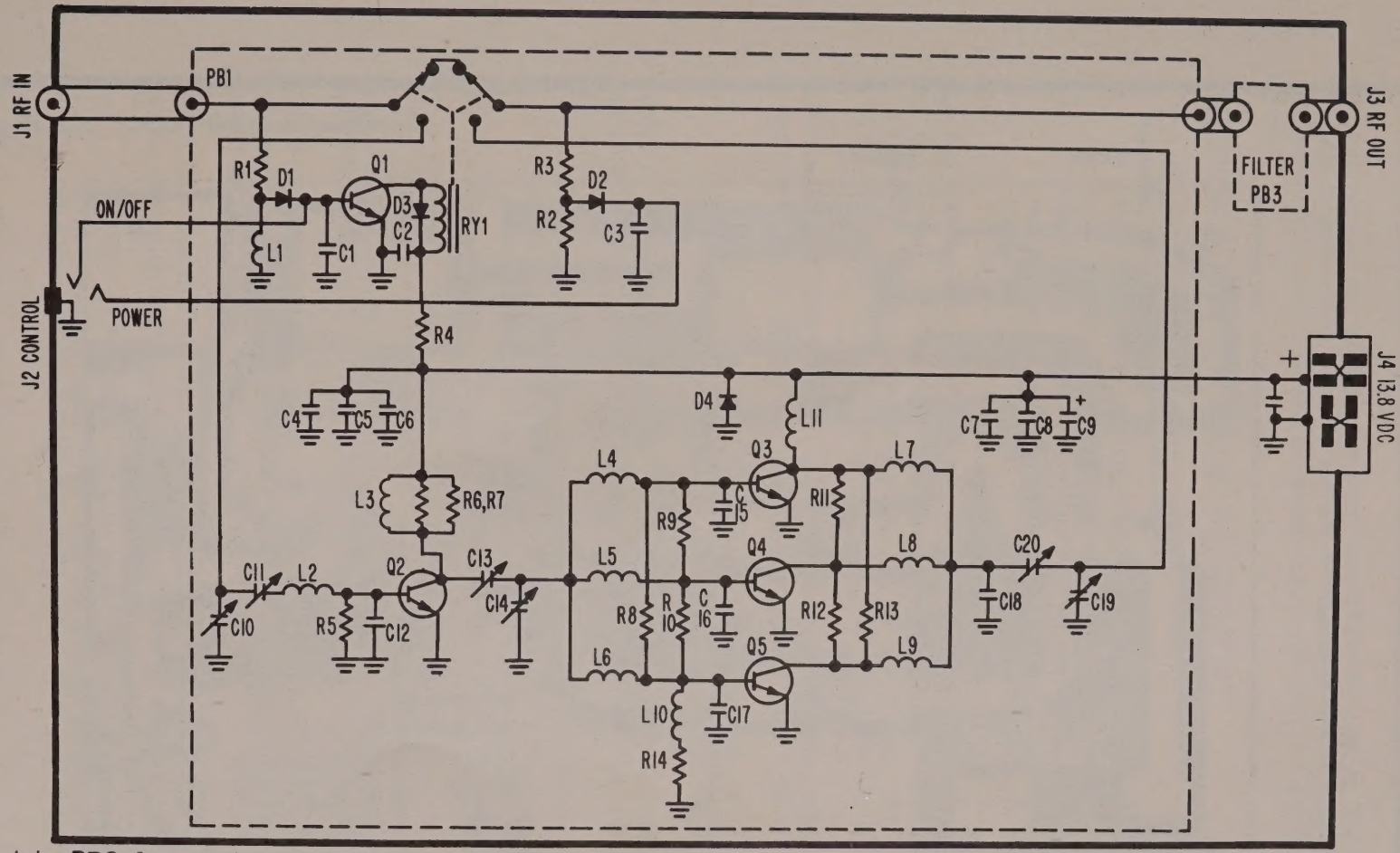
3.4 MODEL 50A02

The 50A02 amplifier is very similar to the 80A02 amplifier.

In the driver stage Q2 is replaced by a lower power transistor for less drive. In the final amplifier stage, Q4 and C16 and related components are deleted for lower output.

3.5 MODEL 50A10

The 50A10 amplifier is identical to the 50A02 in all respects except for the substitution of a low gain transistor at Q2 in the driver stage.



Delete PB3 for amateur amplifiers

Delete R7, R9, R10, R11, R12, C16, L5, L6, and Q4 for 50A02 and 50A10.

Figure 2. C80A02 Schematic.

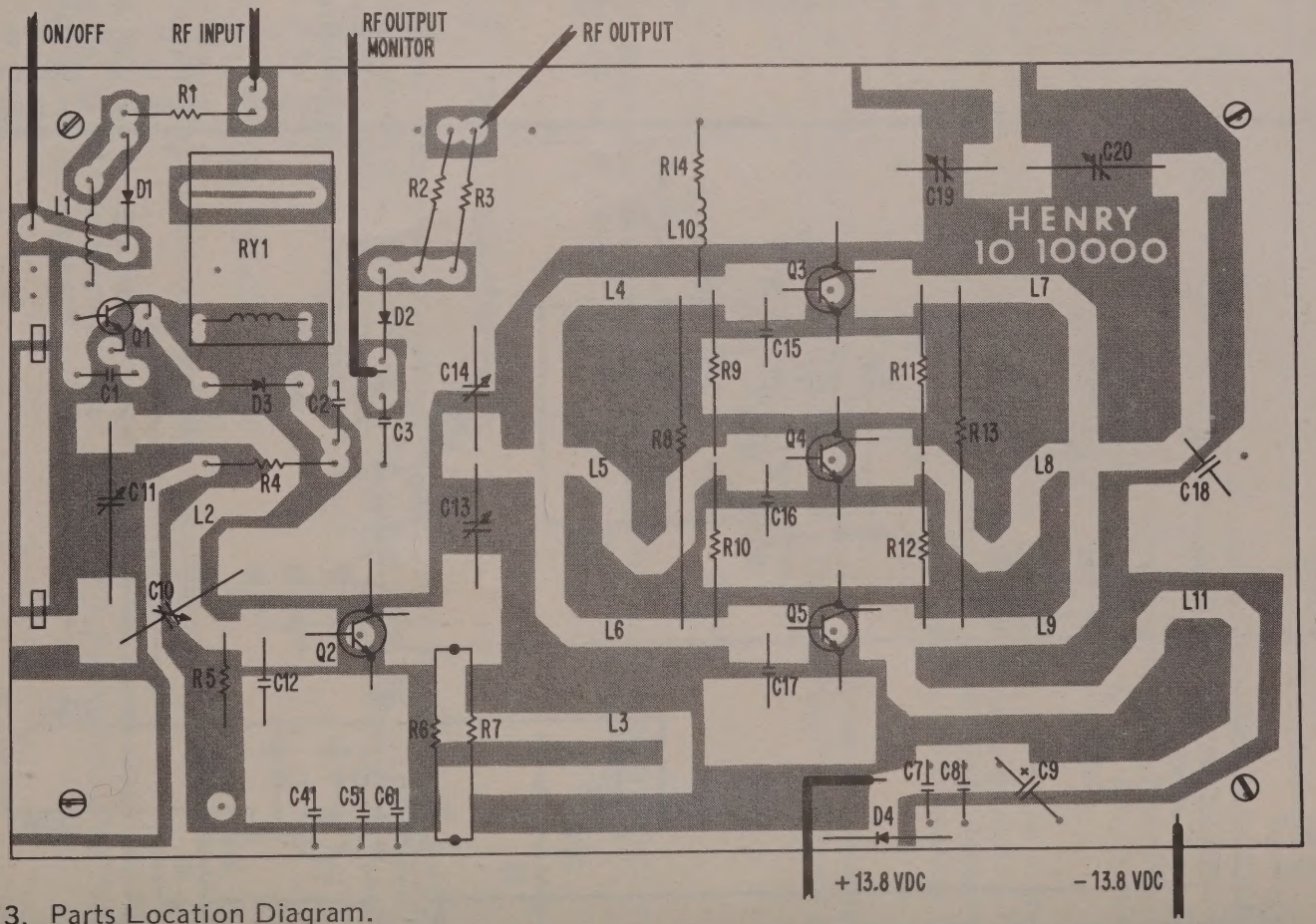


Figure 3. Parts Location Diagram.

3.6 C MODELS

All C models are identical to the other amplifiers except for the addition of a 9-pole low pass filter on the output of the amplifier. The filter reduces the output harmonics of the amplifier approximately an additional 55 to 60 db.

SECTION 4 TESTING AND ALIGNMENT

4.1 MODELS 80A02 AND 50A02

> WARNING: The transistors in these amplifiers are easily damaged if they are shorted. An insulated alignment tool is recommended for all service. The equipment warranty can not extend to transistors shorted during service.

See Figures 3 and 5 for the parts locations, alignment connections, and test equipment. First verify that the RF drive power of the transceiver is proper for the amplifier being used (1 to 4 watts for the A02 modes, 5 to 15 watts for the A10 models, and 20-40 watts for the A30 models.)

Remove the bottom plate of the amplifier and turn the amplifier upside down and make all of the interconnections described in Figure 5.

> CAUTION: The amplifier should be operated into an adequate dummy load whenever it is transmitting.

(STEP 1) Preset the trimmers as described below. Always use an insulated alignment tool. See Figure 3 for the location of C10, C11, C13, C14, C19 and C20.

C10 1/4 turn less than maximum capacity.
C11 1/8 turn less than maximum capacity.
C13 1/4 turn less than maximum capacity.
C14 1/4 turn less than maximum capacity.
C19 1/2 turn less than maximum capacity.
C20 1/8 turn less than maximum capacity.

These figures are for 146 MHz. For frequencies higher than 152 MHz, calibrate the trimmers about 1/8 turn less than described above.

(STEP 2) Apply nominal drive to the amplifier and carefully adjust C10 for minimum SWR between the exciter and the amplifier. The adjustment should be very slight.

(STEP 3) Adjust C13, C14, C11 and C10 until there is an increase of the current drawn by the amplifier from the 13.8 VDC source.

> NOTE: Adjustment of C10 and C11 have a very sharp effect on the input SWR and the output power of the amplifier. Adjust them carefully.

(STEP 4) Adjust C19 and C20 for maximum output.

(STEP 5) Readjust C13 and C14 and then readjust C20 and C19 for for maximum output.

(STEP 6) Readjust C10 and C11 for minimum input SWR and maximum power output.

(STEP 7) Readjust C13, C14, C19 and C20 for maximum output.

(STEP 8) Repeat steps 6 and 7 until the unit meets desired specifications.

4.2 MODELS 80A10, and 50A10

The alignment procedure for these models is identical to the procedure described in Section 4.1. The only difference would be the drive from the exciter.

4.3 MODEL 80A30

Capacitors C10 and C11 are omitted from this model. Follow the alignment procedure described in Section 4.1 but omit the adjustments described for C10 and C11.

SECTION 5 POWER ADJUST

The power input or output of these amplifiers can be adjusted by tuning C13 for the desired power. Transmit into a proper load with a thruline wattmeter inserted in the output of the amplifier. Adjust C13 until the amplifier is operating at the maximum level desired.

Input power to the final stage can be calculated by measuring the DC current to the driver stage.

Power Input (watts) = 13.8VDC x (total amplifier current — driver current.)

SECTION 6 CONTROL AND MONITOR CONNECTION

A dual function control jack is provided on each amplifier to allow remote control and power output monitoring of the amplifier.

As shown in Figure 5, grounding the control line disables the amplifier, connecting the transceiver directly to the antenna. To monitor the relative output power, connect a DC voltmeter or milliameter between ground and the tip of the control plug.

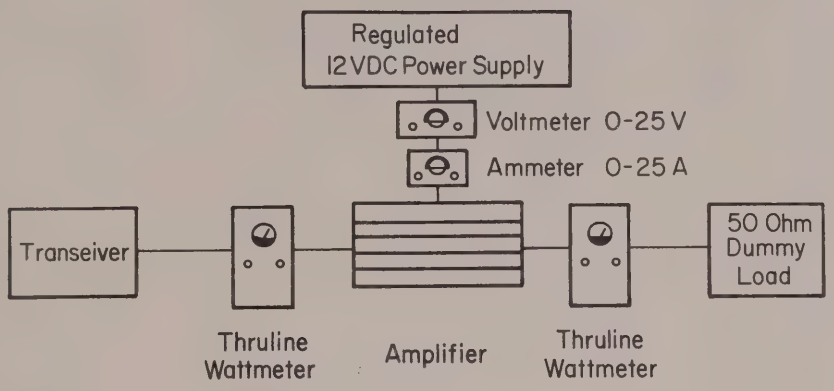


FIGURE 4. Test Circuit Block Diagram.

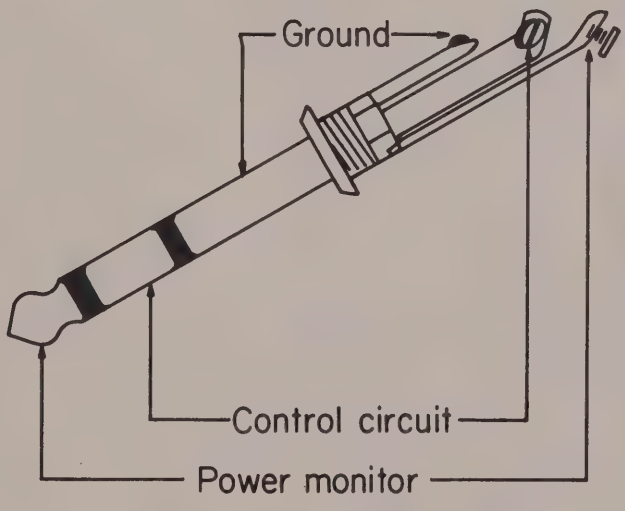


FIGURE 5. Amplifier Control Connections.

SECTION 7 PARTS LISTS

7.1 80A02 PARTS LIST

Schematic No.	DESCRIPTION	Manufacturer
	Box and Packing Material.	Henry
	CABLE: DC primary cable with socket.	Henry
	CABLE: RF drive cable with RF connector.	Henry
	CIRCUIT BOARD: Glass epoxy 80A02 board.	Henry
C1 through C4	CAPACITOR: Ceramic disc, .05 mf, 20 volt.	CTL* UK20-503
C5	CAPACITOR: Ceramic disc, .001 mf, 1000 volt.	CTL* DD-102
C6 and C7	CAPACITOR: Feedthrough type, 1500 pf, 500 volt.	CTL* MFT-1500
C8	CAPACITOR: Same as C1.	
C9	CAPACITOR: Electrolytic tubular, 25 mf, 50 volt.	Arco RME/FJ/025
C10 and C11	CAPACITOR: Miniature ceramic trimmer, 7 - 100 pf, 350 volt.	Arco 423
C12	CAPACITOR: Toothpick type mica capacitor, 200 pf.	Unelco T101-200
C13 and C14	CAPACITOR: Same as C10.	
C15 through C17	CAPACITOR: Same as C12.	
C18	CAPACITOR: Toothpick type mica capacitor, tabbed, 75 pf.	Unelco J101-75
C19 and C20	CAPACITOR: Same as C10.	
C21	CAPACITOR: Same as C5.	
D1 and D2	DIODE: Silicon rectifier, 50 PIV, 1 amp.	1N4148
D3	DIODE: Silicon rectifier, 400 PIV, 1 amp.	1N4004
J1	CONNECTOR: RF INPUT, RCA type phono socket.	Switchcraft 3505F
J2	CONNECTOR: CONTROL, 3 conductor phone jack, ¼".	Switchcraft S-12B
J3	CONNECTOR: RF OUTPUT, type UHF coax connector.	Amphenol 083-1R
J4	CONNECTOR: 13.8 VDC, DC primary connector, 8 pin plug.	Cinch S-308 AB

(continued)

L1	INDUCTOR: RF choke, 3.3 uh.	Miller 9250-332
L2 through L9	INDUCTOR: Printed circuit etched inductors.	
L10	INDUCTOR: 2 turns of R14 lead.	
L11	INDUCTOR: Printed circuit etched inductor.	
	METAL PIECES:	
	Bottom Plate.	Henry
	Chassis.	Henry
	Heat Sink.	Henry
Q1	TRANSISTOR: RF amplifier, type 2N2222.	2N2222
Q2	TRANSISTOR: RF power amplifier, VHF, 40 watts.	CTC B40-12
Q3 through Q5	TRANSISTOR: RF power amplifier, VHF, 25 watts.	CTC B25-12
R1 and R2	RESISTOR: Carbon, 1 K ohm, ½ watt, 10%.	Resistor
R3	RESISTOR: Carbon, 10 K ohm, ½ watt, 10%.	Resistor
R4 and R5	RESISTOR: Carbon, 10 ohm, ½ watt, 10%.	Resistor
R6 and R7	RESISTOR: Carbon, 4.7 ohm, 1 watt, 5%.	Resistor
R8 through R13	RESISTOR: Same as R4.	
R14	RESISTOR: Carbon, 1.0 ohm, ½ watt, 5%.	Resistor
RY1	RELAY: Antenna changeover, 12 VDC.	Guardian 1365-PC

7.2 80A10 PARTS LIST

This amplifier is identical to the 80A02 except that Q2 is replaced by a special TRW low gain transistor.

7.3 80A30 PARTS LIST

This amplifier is identical to the 80A02 except:

C10, C11, C12, R5, R6, R7, L2, and Q2 are deleted from the circuit.

7.4 50A02 PARTS LIST

This amplifier is identical to the 80A02 except for the following changes:

Q2	TRANSISTOR: RF amplifier, VHF, 25 watts.	CTC B25-12
R6	RESISTOR: Carbon, 5.1 ohm, 1 watt, 5%.	Resistor
R14	RESISTOR: Carbon, 2.2 ohm, ½ watt, 5%.	Resistor

Also, R7, R9, R10, R11, R12, C16, L5, L6, and Q4 are deleted from the circuit.

7.5 50A10 PARTS LIST

This amplifier is identical to the 50A02 except that Q2 is replaced by a special TRW low gain transistor.

*CTL = Centralab

NOTE: the parts listed above are typical of those used. From unit to unit the actual values may vary slightly from the listed specifications.

SECTION 8 HENRY /R REPEATER CONFIGURATION FOR SOLID STATE AMPLIFIERS

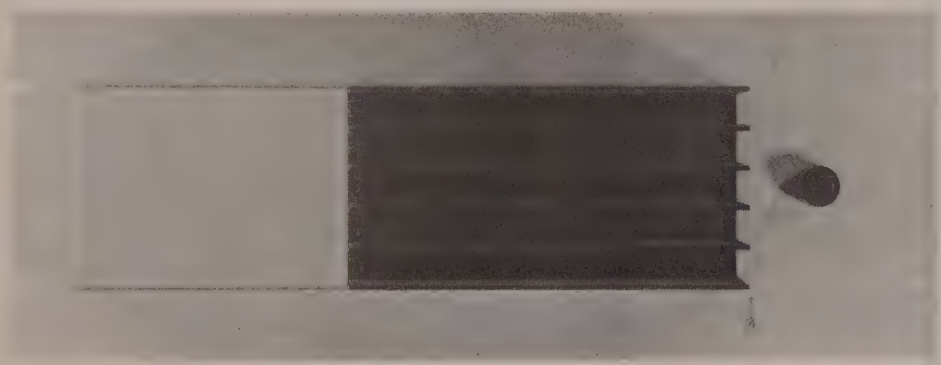
Henry solid state amplifiers which are ordered for repeater operation (continuous duty type operation) will be supplied on a 19" x 7" rack panel as shown in Figure 6.

Each panel will include a cooling fan, mounted on the back of the panel with the air ducted to the front, and a ON/OFF control switch to put the amplifier in or out of the system. The cooling fan supplied will operate from 12VDC unless specially ordered for 110 VAC operation. The fan in the normal configuration is controlled by a heat sensor on the heat sink which closes at approximately 130°F. A second heat sensor, which closes at 225°F, protects the amplifier from destruction caused by a fan failure, or thermal runaway. When the repeater amplifier turns off, the repeater will still operate to the antenna at its non-amplified power level.

Most of the solid state amplifiers are derated to about 80% of their peak output power for continuous duty repeater operation. This means that 70 watt UHF amplifiers will be set up for about 60 watts output in the repeater configuration, and 130 watt VHF amplifiers will be rated at approximately 100 watts.

Each repeater amplifier carries the specifications of the regular amplifier with the exception of rated peak output and duty cycle.

Figure 6. Repeater Configuration.



EQUIPMENT NOTES

TEST DATA

MODEL 500A10

SERIAL NUMBER 515

TUNED FREQUENCY 146 MHz

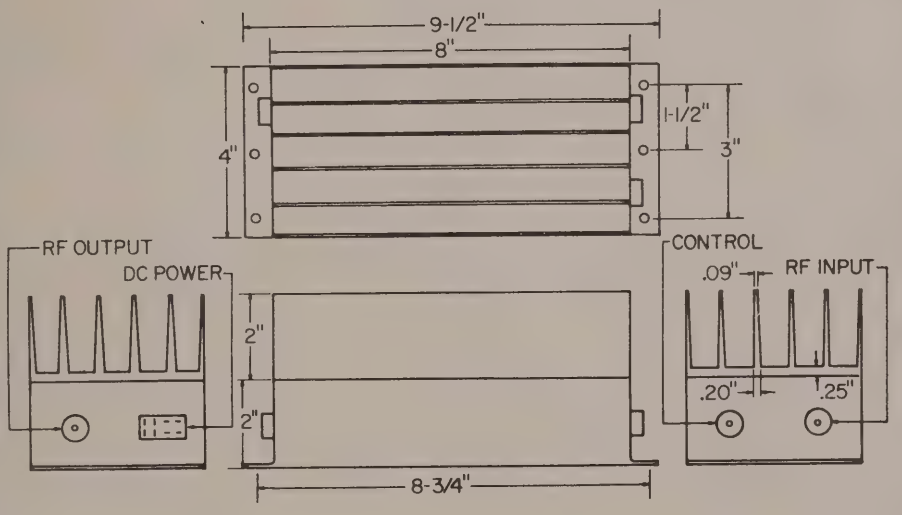
TYPE ACCEPTANCE NUMBER _____

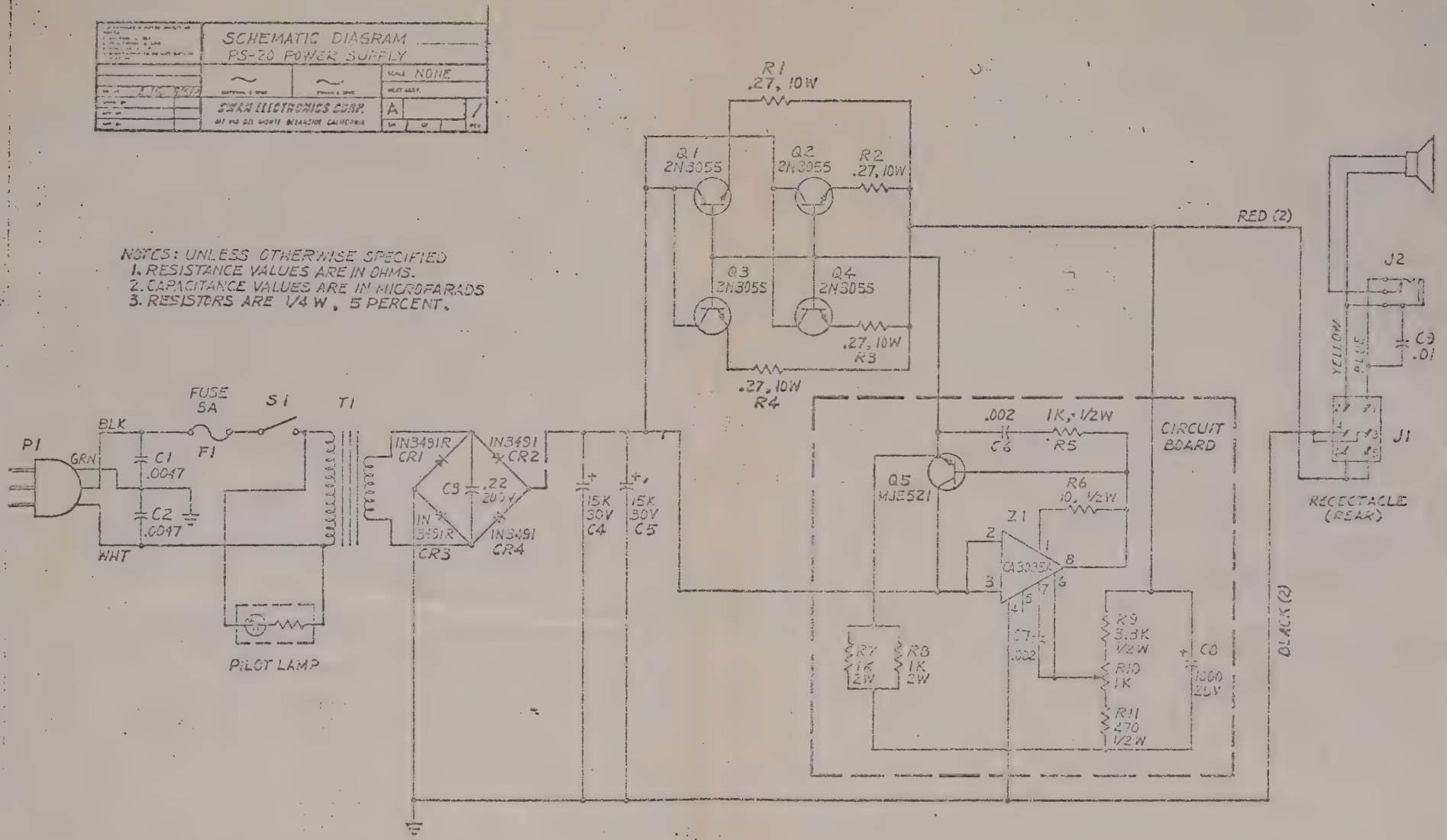
OUTPUT: 50 watts with 10 watts drive at 13.8 VDC.

3/20/7_ DATE

TECHNICIAN

DIMENSIONAL DRAWING

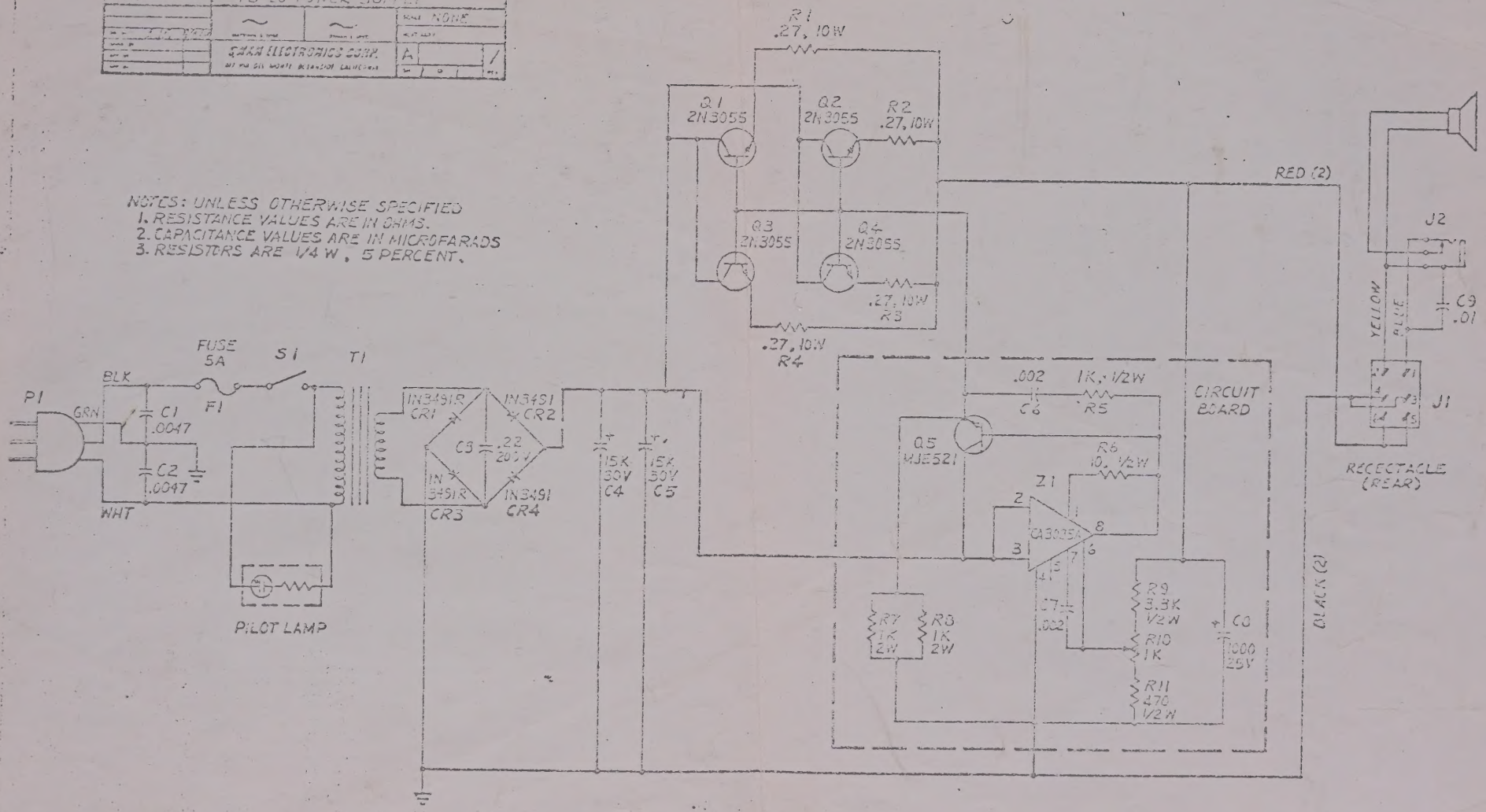



SCHEMATIC DIAGRAM
PS-20 POWER SUPPLY
SCALE NONE
SHAN ELECTRONICS CORP.
NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTANCE VALUES ARE IN OHMS.
2. CAPACITANCE VALUES ARE IN MICROFARADS
3. RESISTORS ARE 1/4 W, 5 PERCENT.
P1
GRN
BLK
WHT
FUSE 5A
F1
S1
T1
C1 .0047
C2 .0047
IN3491R CR1
IN3491 CR2
IN3491 CR3
IN3491 CR4
C3 .22 200V
15K 30V C4
15K 30V C5
PILOT LAMP
R1 .27, 10W
Q1 2N3055
Q2 2N3055
R2 .27, 10W
Q3 2N3055
Q4 2N3055
.27, 10W R3
.27, 10W R4
RED (2)
.002
1K, 1/2W
C6
R5
CIRCUIT BOARD
Q5 MJE521
R6 10, 1/2W
Z1
CA3035A
R7 1K 2W
R8 1K 2W
C7 .002
R9 3.3K 1/2W
R10 1K
R11 470 1/2W
C8 1000 25V
BLACK (2)
J2
YELLOW
BLUE
C9 .01
J1
RECEPTACLE (REAR)

SCHEMATIC DIAGRAM
PS-20 POWER SUPPLY

SAMS ELECTRONICS CORP.

NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTANCE VALUES ARE IN OHMS.
2. CAPACITANCE VALUES ARE IN MICROFARADS
3. RESISTORS ARE 1/4 W, 5 PERCENT.



MOBILE INSTALLATION INSTRUCTIONS FOR

SWAN SOLID STATE TRANSCEIVERS

The mobile mounting kit comes with all the necessary cables, connectors, hardware and fuses for connection of the SS-15, SS-100 or SS-200 to a 12V negative ground automotive electrical system. DO NOT CONNECT THE TRANSCEIVER TO A POSITIVE GROUND SYSTEM.

CAUTION: The speaker terminals can not be connected to the vehicle ground ststem directly. The prewired plug has a two wire audio cable which provides audio to the speaker and a ground return to the transceiver. The use of a speaker with one terminal grounded may result in poor receiver muting in transmit. Additionally, if the connection to a grounded speaker is made in such a way that Pin #1 of the jones plug is grounded, the receiver audio amplifier may be damaged.

The illustration shows the necessary connections for operation of the transceiver. The speaker may be either 4 or 8 ohms. The splices from the ground wires (Black) and +12V wires (Red) to the #10 cables should be wrapped with electrical insulating tape to prevent short circuits. As a safety precaution, the fuse holder should be mounted as near as possible to the battery using the two flat head metal screws. The four solder lugs and remaining metal screw are used to connect the +12V cable to the fuse holder and battery and the ground cable to the chassis. In some cases, it may be necessary to connect the ground cable directly to the engine block to insure an adequate ground. Three fuses are provided with the kit to be used as follows: SS-15 - 3 amp, SS-100 - 15 amp, and SS-200 - 25 amp. DO NOT USE A HIGHER AMPERAGE FUSE THAN THAT WHICH IS SPECIFIED FOR THE PARTICULAR TRANSCEIVER.